Space Weather Forecast

Issued on Friday, 31 March 2023 at 12:09 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of both Minor Radio Blackouts and Minor Geomagnetic Storms peaking today.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity reverted to low over the past 24 hours, with a declining background level of X-ray activity and only occasional small Common-class flares recorded. The peak flare of the period was a mid-ranking C4.4 at 31/0909UTC from a small sunspot group near the northwestern solar horizon. Another event of note was a small Common-class at 30/1948UTC, with this produced by a relatively unassuming spot in the southwest. This event may have produced a small Coronal Mass Ejection (CME), with uncertain attribution to two candidates seen heading mainly ahead of the Sun-Earth line on evening satellite imagery. These have been analysed and are both misses ahead of Earth in the track of its orbit. The emission location of the earlier of the two events could not be determined, but has been inferred from analysis as likely narrowly far-sided.

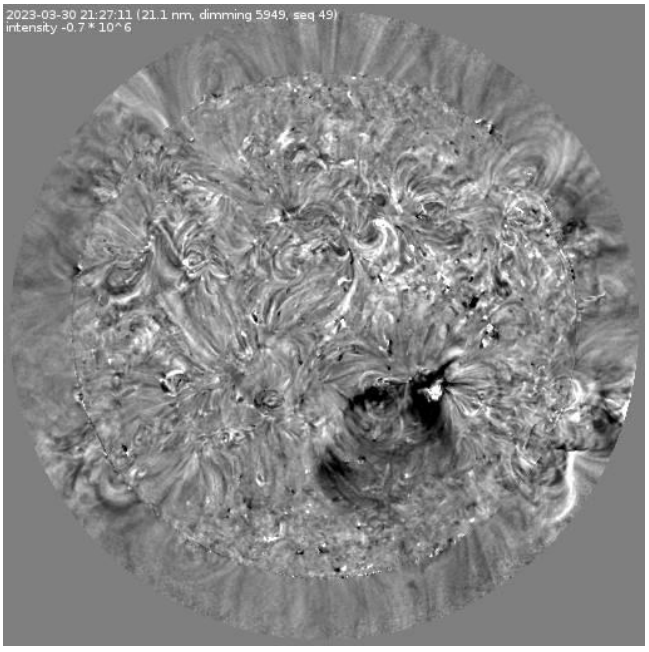

Figure 1: Time-integrated extreme UV imagery of a possible Coronal Mass Ejection (CME)-spwaning event tied to the Common class flare from a small sunspot in the southwest of the Sun at 30/1948UTC. This event has been tentatively linked with some of the ejecta seen heading largely west of the Sun-Earth line in imagery in the following UTC evening – this has been determined to miss Earth in any case. Image processing courtesy of SIDC ROB.

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The above sunspot was one of up to six on the Sun, with a new magnetically bipolar group developing in the northwest. The most active sunspot of recent days became indistinct on the southwestern solar horizon in the period, although it may still survive as some small trailing spots given the unfavourable viewing angle for analysis.

Solar Wind / Geomagnetic Activity: The solar wind showed a ramp-up in the number of particles in the solar wind immediately preceding the 24-hour period, almost exactly giving way to a fast wind as the period began at 30/1200UTC. This was assessed to be a Co-rotating Interacting Region (CIR, a fore-running 'shock') transitioning into a Coronal Hole (fast wind).

The solar wind speed rose from slightly elevated levels to become strong for a time, later moderating to elevated by the period's end. The number of particles in the solar wind fell as the fast wind evolved, while their associated magnetic field showed an erratic falling tendency. The north-south component of their field was mostly anti-aligned with Earth's to greater geomagnetic effect.

The result of the above solar wind measures was for quiet to Minor Geomagnetic Storm G1 conditions, peaking in the 18-21UTC interval. This also tallied with a provisional Kgbi of 6 (which would be equivalent to a Moderate Storm G2 were it not localised for the UK) in the same interval. As part of this, the horizontal-component at BGS's Hartland magnetometer saw an 80nT change in 15 minutes from 30/1945UTC.

Energetic Particles / Solar Radiation: A slight high energy proton enhancement was visible as a result of the 30/0737UTC Moderate class flare from the now departing largest sunspot of the past week, with 10MeV protons peaking at roughly half a pfu (where S1 is 10pfu) before declining to background during the first half of the current 24-hour reporting period.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity carries an initial chance of further Moderate-class flares as the trailing portion of the largest sunspot straddles the southwestern solar horizon. The risk of further such events should then sharply decline, with an uncertain degree of compensation possible from (up to six) arriving eastern solar horizon regions. The latter do not feature in the probabilities, pending arrival for analysis.

Solar Wind / Geomagnetic Activity: A re-analysis of a portion of the 29 March prominence eruption from the southeast of the Sun now presents a slight chance of glancing incidence in the UTC day of 03 April, although the deterministic MOSWOC Enlil run has a miss. This is the only CME to possibly feature in the forecast at present.

The Earth is otherwise experiencing a fast wind regime from a coronal hole, which is likely to bring further strong windspeeds into the coming UTC weekend before waning into the start of the new working week.

There is a chance of Minor Geomagnetic Storm G1 peaking on day one, Friday 31 March, perhaps surviving as a slight chance on Saturday before largely quiet conditions establish through Sunday 02 April. There is then a slight chance of G1 should the 29 April CME glance Earth on 03 April.

Energetic Particles / Solar Radiation: Solar radiation carries a slight chance of breaching S1 given the history of capability from the recent large sunspot and this spot group's remaining in a geoeffective location for at least the start of the four-day forecast period (near the western solar horizon).

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	50	20	1	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	25	10	10	5
Very Active	R3 to R5 X	No	10	1	1	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	5	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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